MOV metal oxide varistors

Leaded varistors, Standard, 14 series

Series/Type:	**VCRR14D***K****
Ordering code:	**VCRR14D***K
Date:	January 2020
Version:	1

Construction

- Round varistor element, leaded
- Coating: epoxy resin, flame-retardant to UL 94 V-0
- Terminals: tinned wire

Features

- High performance with smaller disk diameter
- Wide operating voltage range 10 ... 680V_{RMS}
- High surge current ratings up to 4500 A
- No derating up to 130℃ ambient temperature

Approvals

- UL Certificate:E531647
- TUV Certificate:B1199670002
- CQC Certificate :CQC23001396763

Delivery mode

- Bulk (standard), taped versions on reel or in Ammo pack upon request
- For further details refer to chapter "Taping, packaging and lead configuration" for leaded varistors.

General technical data

Climatic category	to IEC 60068-1	40/130/56	
Operating temperature	to IEC 61051	-40 ... +130	°C
Storage temperature		-40 ... +125	°C
Electric strength	to IEC 61051	≥ 2.5	kV_{RMS}
Insulation resistance	to IEC 61051	≥ 100	MΩ

Electrical specifications and ordering codes

Maximum ratings (T_A = 130 °C)

Ordering code	Type	V_{RMS} [V]	V_{DC} [V]	i_{max} (8/20 µs) 1 time [A]*	I_n[1)] (8/20 µs) 15 times [A]*	W_{max} (10/1000us) [J]	P_{max} [W]
VCRR14D180K0101	14D180L	10	14	1000	500	6.6	0.1
VCRR14D220K0101	14D220K	14	18	1000	500	7.6	0.1
VCRR14D270K0101	14D270K	17	22	1000	500	9.7	0.1
VCRR14D330K0101	14D330K	20	26	1000	500	12.3	0.1
VCRR14D390K0101	14D390K	25	31	1000	500	13.2	0.1
VCRR14D470K0101	14D470K	30	38	1000	500	16.8	0.1
VCRR14D560K0101	14D560K	35	45	1000	500	19.6	0.1
VCRR14D680K0101	14D680K	40	56	1000	500	23.8	0.1
VCRR14D820K0101	14D820K	50	65	4500	2500	29.4	0.1
VCRR14D101K0101	14D101K	60	85	4500	2500	33.6	0.1
VCRR14D121K0101	14D121K	75	100	4500	2500	40.6	0.1
VCRR14D151K0101	14D151K	95	125	4500	2500	51.8	0.1
VCRR14D181K0101	14D181K	115	150	4500	2500	58.8	0.6
VCRR14D201K0101	14D201K	130	170	4500	2500	75.2	0.6
VCRR14D221K0101	14D221K	140	180	4500	2500	79.8	0.6
VCRR14D241K0101	14D241K	150	200	4500	2500	82.6	0.6
VCRR14D271K0101	14D271K	175	225	4500	2500	84	0.6
VCRR14D301K0101	14D301K	190	250	4500	2500	103	0.6
VCRR14D331K0101	14D331K	210	270	4500	2500	112	0.6
VCRR14D361K0101	14D361K	230	300	4500	2500	123	0.6
VCRR14D391K0101	14D391K	250	320	4500	2500	135	0.6
VCRR14D431K0101	14D431K	275	350	4500	2500	145	0.6
VCRR14D471K0101	14D471K	300	385	4500	2500	147	0.6
VCRR14D511K0101	14D511K	320	420	4500	2500	148	0.6
VCRR14D561K0101	14D561K	350	460	4500	2500	150	0.6
VCRR14D621K0101	14D621K	385	505	4500	2500	155	0.6
VCRR14D681K0101	14D681K	420	560	4500	2500	160	0.6
VCRR14D751K0101	14D751K	460	615	4500	2500	180	0.6
VCRR14D821K0101	14D821K	510	670	4500	2500	190	0.6
VCRR14D911K0101	14D911K	550	745	4500	2500	203	0.6
VCRR14D951K0101	14D951K	575	765	4500	2500	208	0.6
VCRR14D102K0101	14D102K	625	825	4500	2500	217	0.6
VCRR14D112K0101	14D112K	680	895	4500	2500	266	0.6

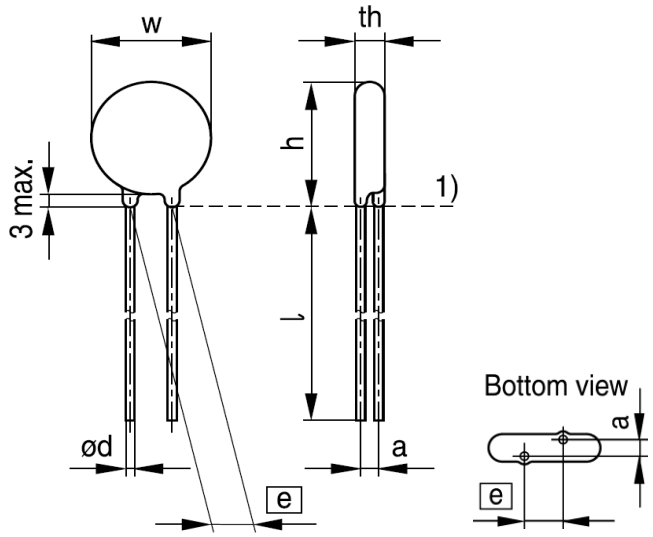
[1)] **Note:** Nominal discharge current is the specification defined in UL1449 4th edition and tested with 8/20 µs current waveform

Characteristics (T_A=25 °C):

Ordering code	Type	V_v (1 mA) [V]	ΔV_v (1 mA) [%]	Max clamping voltage Vc [V]	Max clamping voltage Ic [A]	C_{typ} (1 kHz) [pF]
VCRR14D180K0101	14D180L	18	5	38	10	11100
VCRR14D220K0101	14D220K	22	±10	43	10	9100
VCRR14D270K0101	14D270K	27	±10	53	10	7400
VCRR14D330K0101	14D330K	33	±10	65	10	6100
VCRR14D390K0101	14D390K	390	±10	77	10	5100
VCRR14D470K0101	14D470K	47	±10	93	10	4300
VCRR14D560K0101	14D560K	56	±10	110	10	3600
VCRR14D680K0101	14D680K	68	±10	135	10	2900
VCRR14D820K0101	14D820K	82	±10	135	50	2400
VCRR14D101K0101	14D101K	100	±10	165	50	2000
VCRR14D121K0101	14D121K	120	±10	200	50	1700
VCRR14D151K0101	14D151K	150	±10	250	50	1300
VCRR14D181K0101	14D181K	180	±10	300	50	1100
VCRR14D201K0101	14D201K	200	±10	340	50	900
VCRR14D221K0101	14D221K	220	±10	360	50	830
VCRR14D241K0101	14D241K	240	±10	395	50	740
VCRR14D271K0101	14D271K	270	±10	455	50	670
VCRR14D301K0101	14D301K	300	±10	500	50	610
VCRR14D331K0101	14D331K	330	±10	550	50	560
VCRR14D361K0101	14D361K	360	±10	595	50	510
VCRR14D391K0101	14D391K	390	±10	650	50	460
VCRR14D431K0101	14D431K	430	±10	710	50	430
VCRR14D471K0101	14D471K	470	±10	775	50	390
VCRR14D511K0101	14D511K	510	±10	840	50	360
VCRR14D561K0101	14D561K	560	±10	910	50	320
VCRR14D621K0101	14D621K	620	±10	1025	50	290
VCRR14D681K0101	14D681K	680	±10	1120	50	270
VCRR14D751K0101	14D751K	750	±10	1240	50	260
VCRR14D821K0101	14D821K	820	±10	1355	50	230
VCRR14D911K0101	14D911K	910	±10	1500	50	220
VCRR14D951K0101	14D951K	950	±10	1570	50	200
VCRR14D102K0101	14D102K	1000	±10	1650	50	180
VCRR14D112K0101	14D112K	1100	±10	1815	50	130

2) *Please refer to the suffix code

Dimensional drawings



Weight

Nominal diameter mm	V_{RMS} V	Weight g
14	175…680	1.1…4.5

Different voltage levels result in differences in weight.

Dimensions

Ordering code[2)]	[e] ±1 mm	w_{max} mm	h_{max} mm	th_{max} mm	a_{typ} mm	l_{min} mm	∅d±0.05 mm
VCRR14D180K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D220K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D270K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D330K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D390K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D470K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D560K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D680K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D820K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D101K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D121K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D151K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D181K0101	7.5	15.5	18.5	3.6	1.7	25.0	0.8
VCRR14D201K0101	7.5	15.5	18.5	4.2	1.8	25.0	0.8
VCRR14D221K0101	7.5	15.5	18.5	4.3	1.9	25.0	0.8
VCRR14D241K0101	7.5	15.5	18.5	4.4	2.0	25.0	0.8
VCRR14D271K0101	7.5	15.5	18.5	4.6	2.1	25.0	0.8
VCRR14D301K0101	7.5	15.5	18.5	4.7	1.7	25.0	0.8
VCRR14D331K0101	7.5	15.5	18.5	4.8	1.7	25.0	0.8
VCRR14D361K0101	7.5	15.5	18.5	5.0	1.8	25.0	0.8
VCRR14D391K0101	7.5	15.5	18.5	5.1	1.9	25.0	0.8
VCRR14D431K0101	7.5	15.5	18.5	5.4	1.9	25.0	0.8
VCRR14D471K0101	7.5	15.5	18.5	5.6	1.9	25.0	0.8
VCRR14D511K0101	7.5	15.5	18.5	5.8	2.1	25.0	0.8
VCRR14D561K0101	7.5	15.5	18.5	6.1	2.2	25.0	0.8

Ordering code[2)]	[e] ±1 mm	w_{max} mm	h_{max} mm	th_{max} mm	a_{typ} mm	l_{min} mm	∅d±0.05 mm
VCRR14D621K0101	7.5	15.5	18.5	6.2	2.4	25.0	0.8
VCRR14D681K0101	7.5	15.5	18.5	6.3	2.6	25.0	0.8
VCRR14D751K0101	7.5	15.5	18.5	6.7	2.7	25.0	0.8
VCRR14D821K0101	7.5	15.5	18.5	7.1	3.1	25.0	0.8
VCRR14D911K0101	7.5	15.5	18.5	7.5	3.4	25.0	0.8
VCRR14D951K0101	7.5	15.5	18.5	7.9	3.7	25.0	0.8
VCRR14D102K0101	7.5	15.5	18.5	7.9	4.0	25.0	0.8
VCRR14D112K0101	7.5	15.5	18.5	8.0	4.4	25.0	0.8

2) *Please refer to the suffix code.

Reliability data

Test	Test methods/conditions	Requirement
Varistor voltage	The voltage between two terminals with the specified measuring current applied is called V_V (1 mA_{DC} @ 0.2 ... 2 s).	To meet the specified value
Clamping voltage	The maximum voltage between two terminals with the specified standard impulse current (8/20 µs) applied.	To meet the specified value
Endurance at upper category temperature	1000 h at UCT After having continuously applied the maximum allowable AC voltage at UCT ±2 °C for 1000 h, the specimen shall bestored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured.	|ΔV/V (1 mA)| ≤10%
Surge current derating, 8/20 µs	10 surge currents (8/20 µs), unipolar, interval 30 s, amplitude corresponding to derating curve for 10 impulses at 20 µs	|ΔV/V (1 mA)| ≤10% (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	10 surge currents (2 ms), unipolar, interval 120 s, amplitude corresponding to derating curve for 10 impulses at 2 ms	|ΔV/V (1 mA)| ≤10% (measured in direction of surge current) No visible damage
Electric strength	IEC 61051-1, test 4.9.2 Metal balls method, 2500 V_{RMS}, 60 s The varistor is placed in a container holding 1.6 ±0.2 mm diameter metal balls such that only the terminations of the varistor are protruding. The specified voltage shall be applied between both terminals of the specimen connected together and the electrode inserted between the metal balls.	No breakdown

Test	Test methods/conditions	Requirement
Climatic sequence	The specimen shall be subjected to: a) dry heat at UCT, 16 h, IEC 60068-2-2, test Ba b) damp heat, 1st cycle: 55 °C, 93% r. H., 24 h, IEC 60068-2-30, test Db c) cold, LCT, 2 h, IEC 60068-2-1, test Aa d) damp heat, additional 5 cycles: 55 °C/25 °C, 93% r. H., 24 h/cycle, IEC 60068-2-30, test Db. Then the specimen shall be stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured. Thereafter, insulation resistance R_{ins} shall be measured at V = 500 V.	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$
Rapid change of temperature	IEC 60068-2-14, test Na, LCT/UCT, dwell time 30 min, 5 cycles	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Damp heat, steady state	IEC 60068-2-78, test Ca The specimen shall be subjected to 40 ±2 °C, 90 to 95% r. H. for 56 days without load / with 10% of the maximum continuous DC operating voltage V_{DC}. Then stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured. Thereafter, insulation resistance R_{ins} shall be measured at V = 500 V (insulated varistors only).	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$

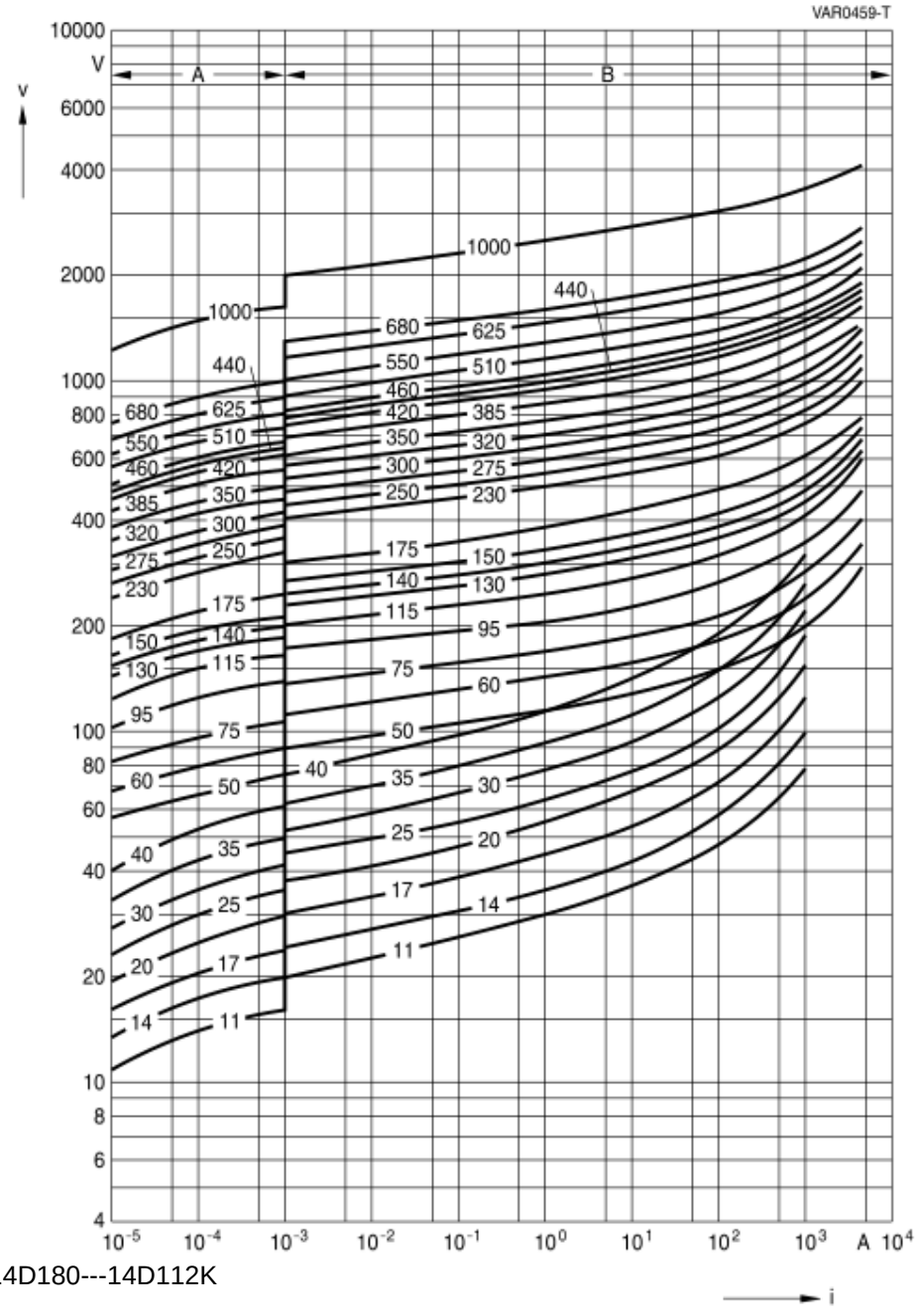
Test	Test methods/conditions	Requirement
Solderability	IEC 60068-2-20, test Ta, method 1 with modified conditions for lead-free solder alloys: 245 °C, 3 s: After dipping the terminals to a depth of approximately 3 mm from the body in a soldering bath of 245 °C for 3 s, the terminals shall be visually examined.	The inspection shall be carried out under adequate light with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4 to 10 times. The dipped surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pinholes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A, 260 °C, 10 s: Each lead shall be dipped into a solder bath having a temperature of 260 ±5 °C to a point 2.0 to 2.5 mm from the body of the specimen, be held there for 10 ±1 s and then be stored at room temperature and normal humidity for 1 to 2 h. The change of VV shall be measured and the specimen shall be visually examined.	|ΔV/V (1 mA)| ≤5% No visible damage
Tensile strength	IEC 60068-2-21, test Ua1 After gradually applying the force specified below and keeping the unit fixed for 10 s, the terminal shall be visually examined for any damage. Force for wire diameter: 0.6 mm = 10 N 0.8 mm = 10 N 1.0 mm = 20 N	|ΔV/V (1 mA)| ≤5% No break of solder joint, no wire break

Test	Test methods/conditions	Requirement
Vibration	IEC 60068-2-6, test Fc, method B4 Frequency range: 10 … 55 Hz Amplitude: 0.75 mm or 98 m/s^2 Duration: 6 h (3 · 2 h) Pulse: sine wave After repeatedly applying a single harmonic vibration according to the table above. The change of V_V shall be measured and the specimen shall be visually examined.	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Bump	IEC 60068-2-29, test Eb Pulse duration: 6 ms Max. acceleration: 400 m/s^2 Number of bumps: 4000 Pulse: half sine	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Fire hazard	IEC 60695-11-5 (needle flame test) Severity: vertical 10 s	5 s max.

Note:
UCT = Upper category temperature
LCT = Lower category temperature
R_{ins} = Insulation resistance

v/i characteristics

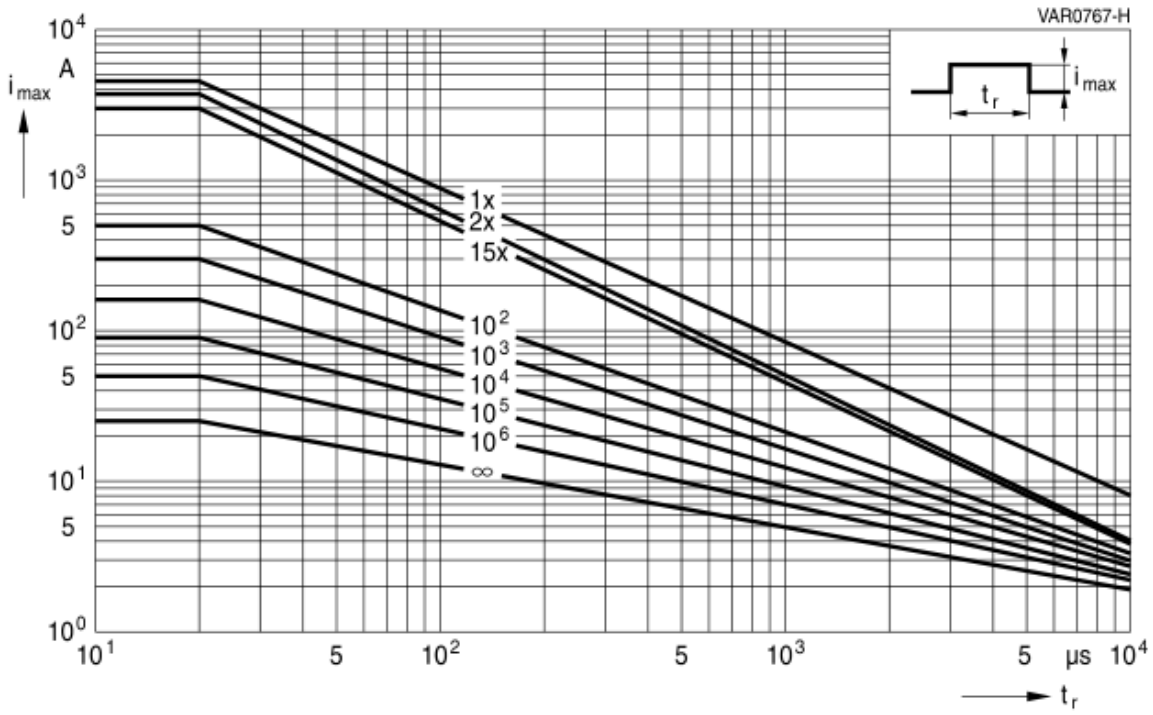
v = f (i) - for explanation of the characteristics refer to "General technical information", 1.6.3
A = Leakage current, B = Protection level } for worst-case varistor tolerances



VCRR14D180---14D112K

Derating curves

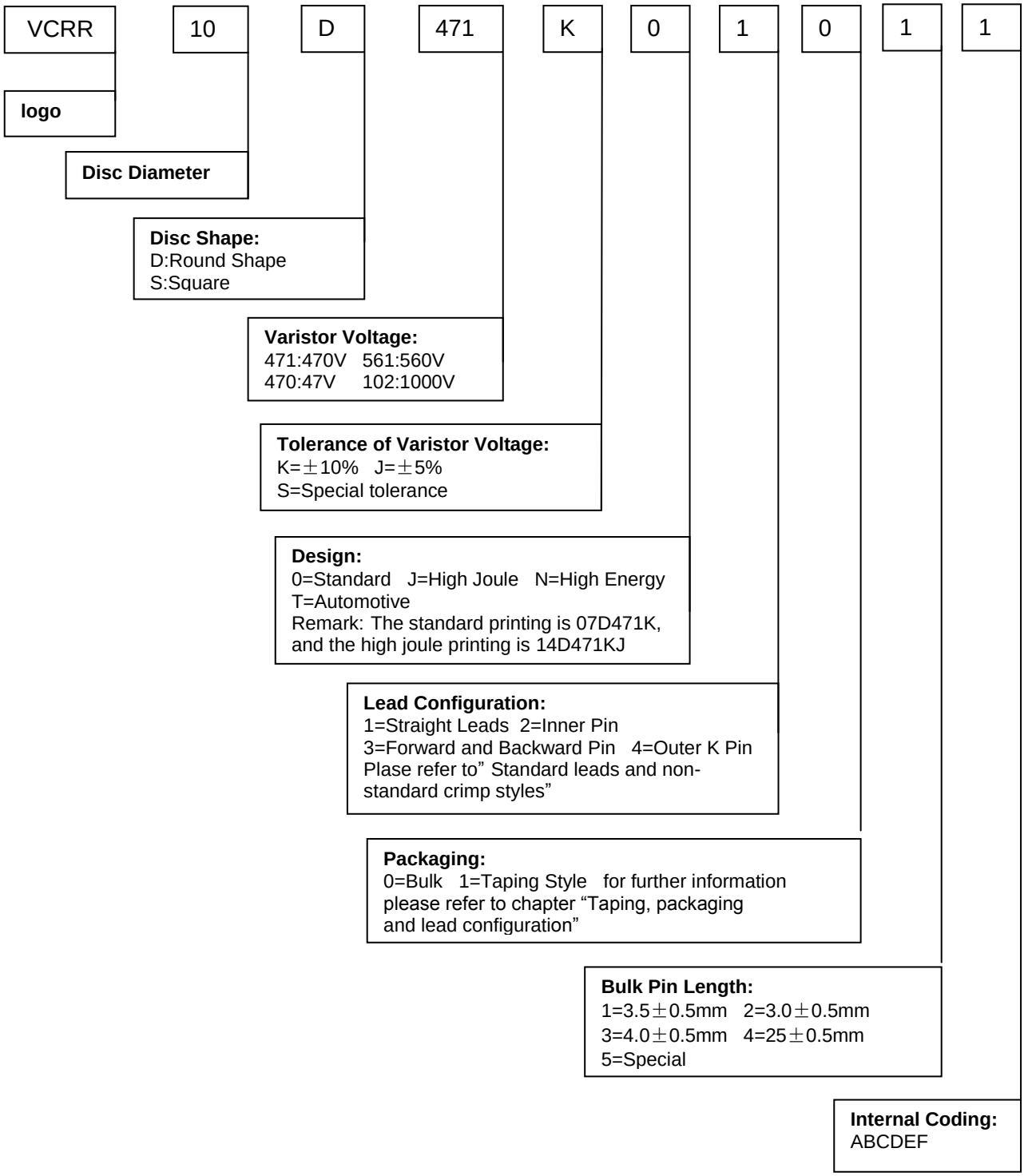
Maximum surge current $i_{max} = f(t_r$, pulse train)
For explanation of the derating curves refer to "General technical information", section 1.8.1



VCRR14D180---VCRR14D112K

Taping, packaging and lead configuration

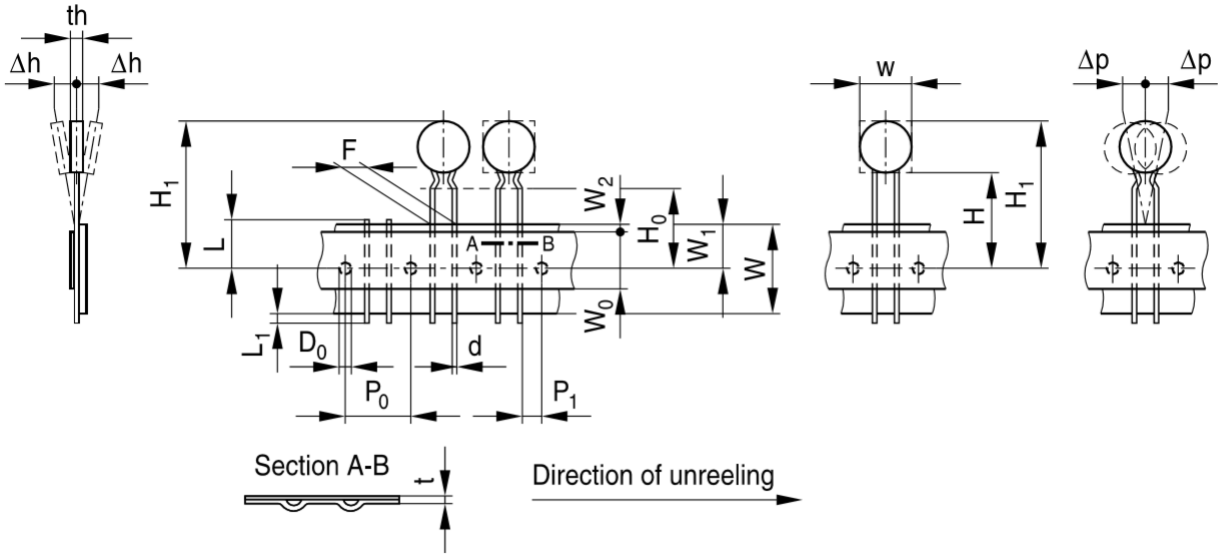
1 JORDUN Electronics ordering code system for leaded varistors



2 Taping and packaging of leaded varistors

Tape packaging for lead spacing $\boxed{e}$ = 5 fully conforms to IEC 60286-2, while for lead spacings $\boxed{e}$ = 7.5 and 10 the taping mode is based on this standard.

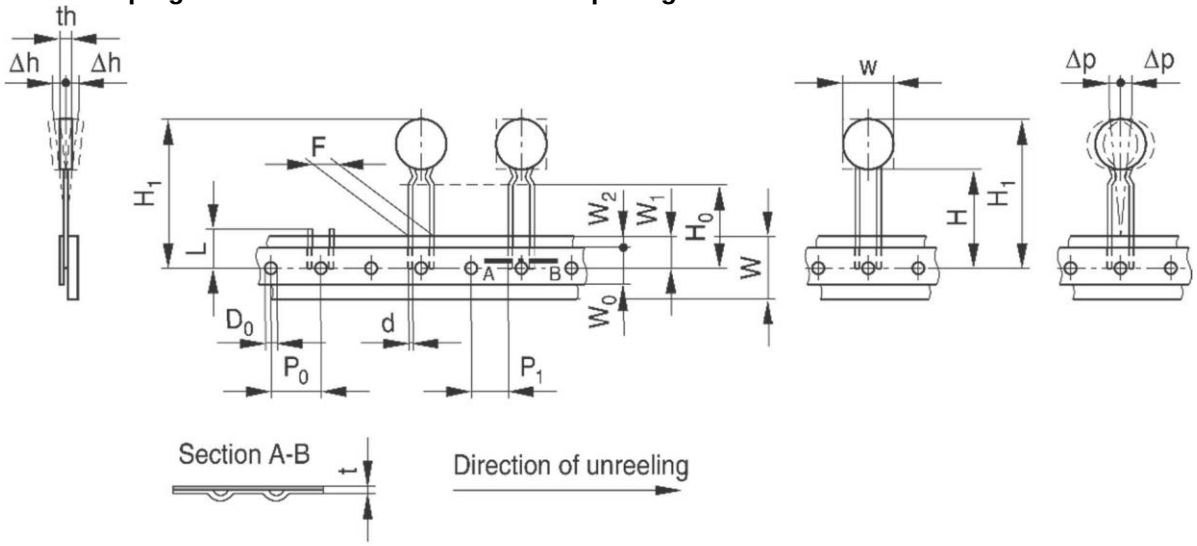
2.1 Taping in accordance with IEC 60286-2 for lead spacing 5.0 mm



F ≙ e = 5.0 mm

VAR0410-X-E

2.2 Taping based on IEC 60286-2 for lead spacing 7.5 and 10 mm



F ≙ e = 7.5 mm

F ≙ e = 10 mm

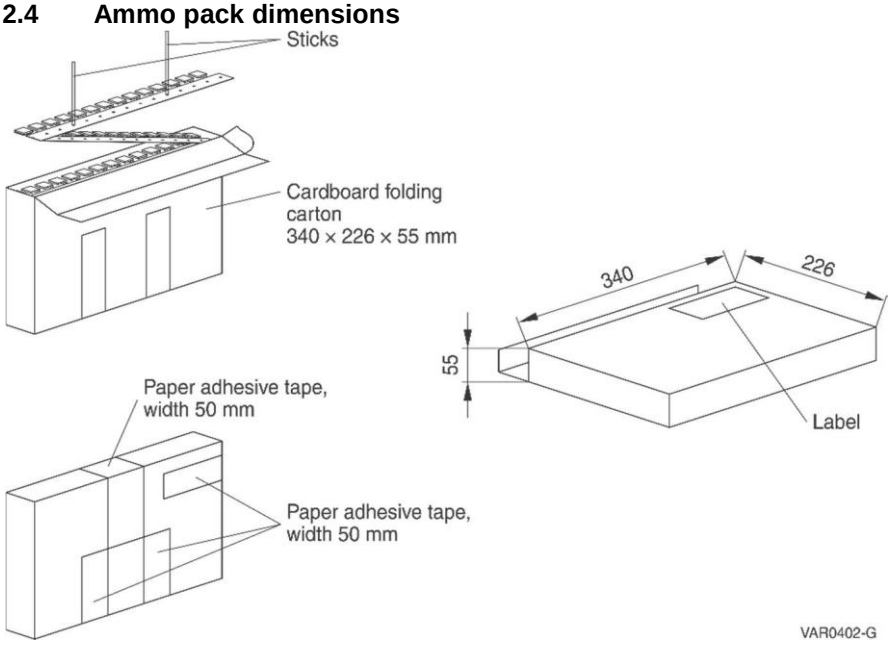
VAR0395-J-E

2.3 Tape dimensions (in mm)

Symbol	ê = 5.0	Tolerance	ê = 7.5	Tolerance	ê = 10.0	Tolerance	Remarks
w th d 0.6		max. max. ±0.05		max. max. ±0.05		max. max. ±0.05	see tables in each series under "Dimensions "
P_0	12.7	±0.3	12.7[1]	±0.3	12.7	±0.3	±1 mm/20 sprocket holes
P_1	3.85	±0.7	8.95	±0.8	7.7	±0.8	
F	5.0	±10	7.5	±0.8	10.0	±0.8	
Δh	0	±2.0	depends on s		depends on s		measured at
Δp	0	±1.3	0	±2.0	0	±2.0	top of compo-nent body
W	18.0	±0.5	18.0	±0.5	18.0	±0.5	
W_0	5.5	min.	11.0	min.	11.0	min.	Peel-off force ≥ 5 N
W_1	9.0	±0.5	9.0	+0.75/−0.5	9.0	+0.75/−0.5	
W_2	3.0	max.	3.0	max.	3.0	max.	
H	18.0		18.0		18.0		[2]
H_0	16.0	+2.0/−0 ±0.5	16.0	+2.0/−0 ±0.5	16.0	+2.0/−0 ±0.5	[3]
	(18.0)		(18.0)				
H_1	32.2	max.	45.0	max.	45.0	max.	
D_0	4.0	±0.2	4.0	±0.2	4.0	±0.2	
t	0.9	max.	0.9	max.	0.9	max.	without lead
L	11.0	max.	11.0	max.	11.0	max.	
L_1	0.5	max.					

1) Taping with P_0 = 15.0 mm upon request
2) Applies only to uncrimped types
3) Applies only to crimped types (H_0 = 18 upon request

2.4 Ammo pack dimensions



2.5 Quantities Per Packaging

Part No	Voltage	Bulk		Ammo Packing(Taping)	
		Bag	Carton	Box	Carton
7D	181-821	1000	20000	1000	10000
10D	180-182	1000	10000	1000	10000
14D	180-182	500	8000	800	8000
20D	180-182	250	5000	----	----
25D	180-182	200	3000	----	----

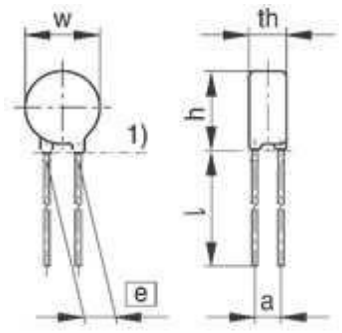
3 Lead configuration

Straight leads are standard for disk varistors. Other lead configurations as crimp style or customerspecific lead wire length according to 3.1, 3.2, 3.3 and 3.4 are optional. Crimped leads (non-standard) are differently crimped for technical reasons; the individual crimp styles are denot-ed by consecutive numbers (S, S2 through S5) as shown in the dimensional drawings below.
The crimp styles of the individual types can be seen from the type designation in the ordering tables.

3.1 Standard leads and non-standard crimp styles

The basic dimensions in figure 1 to 5 are valid for types with either round or square (EnergetiQ series) component head

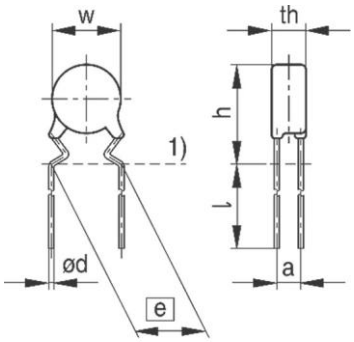
Standard, straight leads



1) Seating plane to IEC 717
VAR0586-W-E

Figure 1

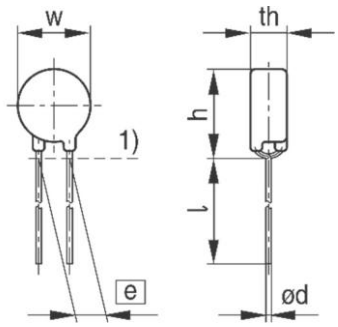
Non-standard, crimp style S2



1) Seating plane to IEC 60717
VAR0411-F-E

Figure 2

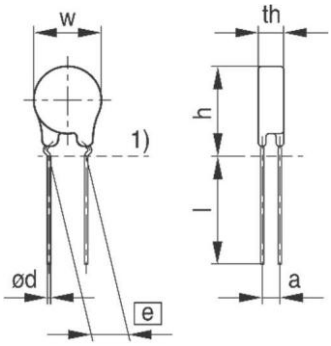
Non-standard, crimp style S3



1) Seating plane to IEC 60717
VAR0396-R-E

Figure 3

Non-standard, crimp style S5



1) Seating plane to IEC 60717
VAR0726-M-E

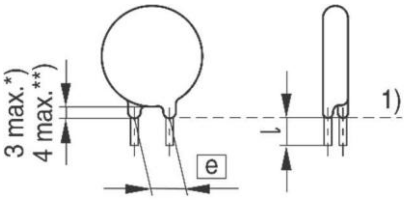
Figure

3.2 Trimmed leads (non-standard)

Varistors with cut leads available upon request.

Lead length tolerances:

Straight leads	+/-0.8 mm
Crimped leads	+/-0.5 mm
Minimum lead length	3.0 mm



1) Seating plane to IEC 60717
*) For round component head
**) For EnergetiQ series, square component head
VAR0642-U-E

Cautions and warnings

General

1. JORDUN Electronics metal oxide varistors (MOV) are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with JORDUN Electronics during the design-in-phase.

2. Ensure suitability of MOV through reliability testing during the design-in phase. The MOV should be evaluated taking into consideration worst-case conditions.

3. For applications of MOV in line-to ground circuits based on various international and local standards there are restrictions existing or additional safety measures required.

Storage

1. Store MOV only in original packaging. Do not open the package prior to processing.

2. Recommended storage conditions in original packaging:

Storage temperature:	-25 °C … +45 °C
Relative humidity:	<75% annual average, <95% on maximum 30 days a year.
Dew precipitation:	Is to be avoided.

3. Avoid contamination of an MOV's during storage, handling and processing.

4. Avoid storage of MOVs in harmful environments that can affect the function during long-term operation (examples given under operation precautions).

5. The MOV type series should be soldered after shipment from JORDUN ELECTRONIC within the time specified.

MOV-J,N,T	24 months

Handling

1. MOVs must not be dropped.

2. Components must not be touched with bare hands. Gloves are recommended.

3. Avoid contamination of the surface of MOV electrodes during handling, be careful of the sharp edge of MOV electrodes.

Soldering (where applicable)

1. Use rosin-type flux or non-activated flux.

2. Insufficient preheating may cause ceramic cracks.

3. Rapid cooling by dipping in solvent is not recommended.

4. Complete removal of flux is recommended.

5. Temperatures of all preheat stages and the solder bath must be strictly controlled especially for T series (T14 and T20).

Mounting

1. Potting, sealing or adhesive compounds can produce chemical reactions in the MOV ceramic that will degrade the component's electrical characteristics.

2. Overloading MOVs may result in ruptured packages and expulsion of hot materials. For this reason the MOVs should be physically shielded from adjacent components.

Operation

1. Use MOVs only within the specified temperature operating range

2. Use MOVs only within the specified voltage and current ranges.

3. Environmental conditions must not harm the MOVs. Use MOVs only in normal atmospheric conditions. Avoid use in the presence of deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, etc), corrosive agents, humid or salty conditions, Avoid contact with any liquids and solvents.

Symbols and terms

Symbol	Term
C	Capacitance
C_{typ}	Typical capacitance
i	Current
i_c	Current at which $V_{c, max}$ is measured
I_{leak}	Leakage current
i_{max}	Maximum surge current (also termed peak current)
I_{max}	Maximum discharge current
I_n	Nominal discharge current to UL 1449
LCT	Lower category temperature
L_{typ}	Typical inductance
P_{max}	Maximum average power dissipation
R_{ins}	Insulation resistance
R_{min}	Minimum resistance
T_A	Ambient temperature
t_r	Duration of equivalent rectangular wave
UCT	Upper category temperature
v	Voltage
V_{clamp}	Clamping voltage
$v_{c, max}$	Maximum clamping voltage at specified current i_c DC operating voltage
V_{DC}	Maximum jump start voltage
V_{jump}	Maximum voltage
v_{max}	Operating voltage
V_{op}	AC operating voltage, root-mean-square value
V_{RMS}	Root-mean-square value of max. DC operating voltage incl. ripple current
$V_{RMS, op, max}$	Super imposed surge voltage
V_{surge}	Varistor voltage
V_V	Tolerance of varistor voltage
ΔV_V	Maximum load dump
W_{LD}	Maximum energy absorption
W_{max}	
e	Lead spacing

All dimensions are given in mm.

The commas used in numerical values denote decimal points.

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